TTi 1200B & 1202B

PHASE JITTER TEST SETS

Interim Operating Instructions

TELeCOMMUNiCATiONS TEC

Electronic Services - Los Angeles
M14492X

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TTI 1200B & 1202B
PHASE JITTER TEST SETS
INTERIM OPERATING INSTRUCTIONS

1. GENERAL

1.01 This document describes the 1200B and 1202B Phase Jitter Test Sets and procedures to be followed in using the instruments. Also included is information on TTI's warranty and factory repair service.

1.02 Except for the carrier frequency feature, which is standard equipment in the 1202B, the 1200B and 1202B test sets are identical. For this reason, the discussions that follow refer to the 1200B and 1202B as the "Test Set". When reading this document in connection with the 1200B, simply disregard any references to the carrier feature,which is unique to the 1202B.

1.03 The TTI 1200B and 1202B Phase Jitter Test Sets measure phase jitter at voice-frequency (VF) points on transmission facilities. The 1202B also measures phase jitter at carrier frequencies. In addition,the Test Set incorporates a 1010 Hz oscillator. The Test Set receives a test tone from the far end and provides a digital display of the phase jitter present on the test tone. The measurement range is from 00.0 degrees to 99.9 degrees.

1.04 The Test Set automatically phase locks to the test tone frequency. Therefore no manual adjustments are necessary for setting signal level or for maintaining phase-lock.

1.05 The Test Set incorporates three operating modes. These three modes, designated STANDARD, STD & LF (standard plus low frequency), and WIDEBAND, are explained in detail in Section 2.

1.06 The Test Set is a portable instrument which operates from 115 Vac or 230 Vac (switch selectable). The only required connection, besides power, is the input signal, which can access the test set in one of the following methods:

a. VF (voice frequency) jack--a standard tip-ring jack which accommodates a 310 plug
b. rear terminals for VF connection
c. CXR (carrier input) jack--a standard 75-ohm coaxial jack.

1.07 Other features that are standard equipment in the Test Set includes:

a. DIAL/MEASURE capability which allows a dial set to be plugged in, a test circuit dialed, then a measurement made without dropping the line.
b. Push-button selection of 600-ohm, 900-ohm, or bridging input.
c. Oscillator output with a 1010 Hz $\pm$2 Hz signal at either 0 dBm or -29 dBm.
d. Damping, which determines whether the measurement is averaged over 0.1 or 1.0 second period.
e. Rear-panel detected-signal output terminals.

1.08 Either of the two test sets, the 1200B or the 1202B can be mated with the TTI 1201A Hit Monitor to form a single instrument. This combination allows phase hits, gain hits and drop outs to be counted and displayed. When the 1201A Hit Monitor is used, power and signal input

are received from the Phase Jitter Test Set. Details on the TTI 1201A Hit Monitor are covered in a separate manual.

2. OPERATING CONTROLS, INDICATORS AND CONNECTIONS

Front Panel

2.01 The following operating controls, indicators, and connections appear on the front panel of the Test Set. They are listed here from left to right and top to bottom.

a. POWER indicator. The LED indicator lights when the power switch is turned ON. The LED is OFF when power is turned OFF.

b. POWER switch. This push-button switch turns the instrument ON and OFF. The Test Set is turned OFF when the switch is IN. The Test Set is turned ON when the switch is OUT. When the optional front cover is locked in place over the front panel, the instrument is turned OFF, and cannot be accidentally left ON.

c. DIGITAL DISPLAY. Three Nixie tubes in the digital display provide a direct readout of phase jitter to a resolution of 0.1 degree. The display is automatically blanked when the incoming signal is outside the proper level range (-40 to +10 dBm) or when the instrument is not phase locked to the incoming signal frequency. The display is also blanked under certain conditions in the STD (standard) operating mode (see d,2 below). A decimal point on the left side of the display acts as an over-range indicator. This decimal is located inside the left Nixie tube and lights to indicate any measurement over 99.9 degrees.

d. MODE. This three-position switch selects one of the three operating modes. Operation in these modes is as follows:

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1. STD + LF (standard plus low frequency). The STD + LF measurement mode responds to low frequency perturbations as well as standard phase jitter. In this mode the Test Set is responsive to jitter components from ±5 Hz to ±350 Hz (3-dB points) of the test tone frequency (1020 Hz ±40 Hz). The range of measurement in this mode is 0.00 to 99.9 degrees (single range).
2. STD (standard). The STD measurement mode responds to jitter components from ±14 Hz to ±350 Hz (3-dB points) of the test tone frequency (1020 ±40 Hz). The STD mode is identical to STD + LF, except for the extended low-frequency capability in STD + LF.
3. WIDEBAND. The WIDEBAND measurement mode responds to all components throughout the bandwidth of the applied signal, except for those components below 210 Hz and those within ±14 Hz of the test tone frequency (3-dB points). This mode is not responsive to test tone harmonics.

d. DIAL jack. The DIAL jack, in conjunction with the DIAL/MEASURE, switch allows a dial set to be connected to the Test Set and a test circuit to be dialed up. Once the connection is made, the Test Set holds the circuits during measurements. The DIAL jack accepts a standard 310-type plug.

e. DIAL/MEASURE switch. This is a two-position toggle switch. In the DIAL position, the switch parallels the VF INPUT jack and the DIAL jack to allow a test circuit to be dialed up. Once the test circuit is up, the switch can be placed to MEASURE and the circuit is held while a measurement is being made. During the measurement, the DIAL jack is disconnected from the VF INPUT jack, and the dial set may be removed. To avoid dropping the circuit,

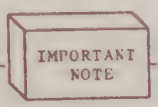
do not disconnect the dial set until the switch is in MEASURE.

f. VF Input Z. This three-button group selects the proper Test Set input impedance for the VF input: 600 ohms, 900 ohms, or BRDG (bridging).

g. DAMPING. This push-button switch selects low or high damping. If the displayed reading varies rapidly, the DAMPING switch may be pushed to select high damping. The display is then updated at one-second intervals, rather than the normal intervals of 0.1 second.

h. INPUT. The INPUT group consists of a VF input jack for a 310-type plug, a MON (monitor) indicator, and a standard 75-ohm coaxial 358-type jack for CXR (carrier) input. The INPUT MON is an LED indicator which is illuminated only when the input signal level (VF or CXR) is below -40 dBm. If the INPUT MON goes OFF and the display remains blanked, a high noise input may be raising the input signal level above -40 dBm without providing a stable signal for the phase-lock loop to lock on. The display normally blanks as the MON indicator comes on.

i. CXR FREQ (kHz) (carrier frequency). This group of three push-buttons selects an internal crystal oscillator that allows the Test Set to accept a specific carrier frequency. The push-buttons are marked (in kHz) with the carrier frequency. Standard carrier frequency buttons are 108, 3100, and 3396 kHz. Other frequencies are available on special order.



Do not attempt to make VF and CXR measurements simultaneously. When any one of the CXR FREQ push-buttons is depressed, the VF jack is disabled. When all CXR FREQ push-buttons are out, the CXR jack is disabled.

j. 600Ω OUTPUT (oscillator). The 600Ω output group consists of a level-select toggle switch and a jack for a 310-type plug. The toggle switch presets the output level to 0 dBm or -29 dBm. The oscillator supplies a balanced output at 1010 Hz ±2.0 Hz.

Rear Panel

2.02

a. The Test Set rear panel is arranged in the following manner: SIGNAL INPUT (TB1). These terminals are connected in parallel with the INPUT jack on the front panel. They may be used instead of the jack to accept the incoming signal as follows:

TABLE 1
REAR TERMINAL PANELS

Terminal	Function
GRD	Sleeve
*IN	Tip
*IN	Ring

*Tip or ring can be connected to either IN terminal (not polarized).

b. OUTPUT (TB2). These terminals supply a detected phase jitter (analog) output. The output level is proportional to the phase jitter reading in that 10 degrees = 1 volt ±10%. These terminals are unbalanced and have a source impedance of 10K ohms.

c. 115/230. This slide-switch modifies the power supply configuration to accept either 115 Vac or 230 Vac input voltage.

3. OPERATION

Connecting the Test Set

3.01 Connect the Test Set as follows:

a. Set the front panel POWER switch to the IN (OFF) position.

b. Set the power slide-switch on the rear panel for the voltage to be used, 115 Vac (UP) or 23 Vac (down)

CAUTION

CHECK FOR THE PROPER FUSE. 115 Vac operation requires 1/2 amp slo-blo fuse. 230 Vac operation requires 1/4 amp slo-blo. These fuses are clipped to the rear of the Test Set.

c. Plug in the power cord.

d. Set the front panel POWER switch to the OUT (ON) position. At this point, the POWER and MON indicators should be ON.

e. Connect the circuit to be tested to the INPUT jack or to the SIGNAL INPUT terminals on the rear panel. The MON indicator will go OFF if the input signal is above -40 dBm, or remain ON if the signal is below -40 dBm.

f. Depress the VF INPUT Z button corresponding to the circuit source impedance 600 ohm, 900 ohm, BRDG.

g. Proceed with the appropriate measurements as described below.

IMPORTANT NOTE

If the test circuit is to be dialed up, perform the steps of paragraph 3.05 then proceed with the measurement.

VF Phase Jitter Tests

3.02 Once the Test Set is properly connected, the phase jitter measurement can be read directly from the digital display in degrees. Since

phase jitter test sets respond to a variety of transmission impairments other than true phase jitter, a comparison of three Test Set operating modes should be made. For example, if the STD reading is 10 degrees and the WIDEBAND reading is approximately 20 degrees, this two-to-one ratio indicates that the readings are caused by random noise, and virtually no phase jitter is present. Refer to Table 2 for a summary of the conclusions to be drawn from a comparison of the three modes.

TABLE 2

Isolation of Transmission Impairments
by Comparison of Operating Modes

MEASUREMENT			IMPAIRMENT
STD + L.F.	STANDARD	WIDEBAND	
X	X	2X	Wideband noise
X	X	X	True Phase Jitter
>X	X	X	Phase perturbation below 20 Hz
X	X	>2X	Single Frequency Interference.

3.03 More detailed information on the three operating modes follows:

a. STD + LF. This mode requires a 1020 Hz ±40 Hz test tone and will measure components from ±5 Hz to ±350 Hz of the test tone frequency (3 dB points). Figure 1 shows both sides of a VF reference tone and gives the STD + LF points as they relate to standard response limits specified in Bell System Technical Reference PUB 41009.

b. STANDARD. This mode requires a 1020 Hz ±40 Hz test tone and will measure components from ±14 Hz to ±350 Hz of the test tone frequency (3 dB points). Figure 1 shows both sides of a VF reference tone and gives the STANDARD points as they relate to standard response limits specified in the Bell System Technical Reference PUB 41009.

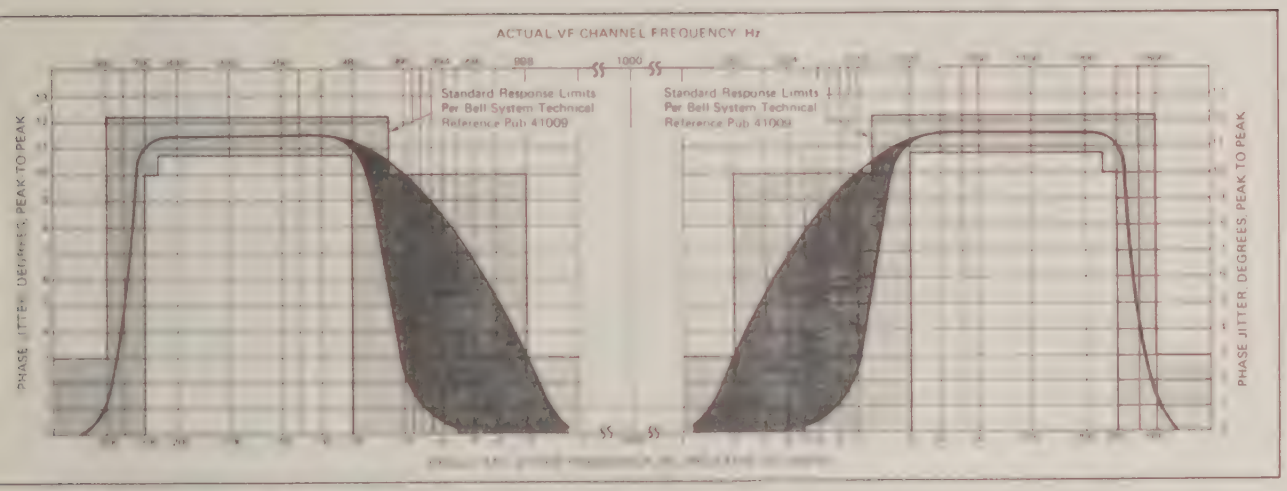

ACTUAL VF CHANNEL FREQUENCY Hz
Standard Response Limits
Per Bell System Technical
Reference Pub 41009
Standard Response Limits
Per Bell System Technical
Reference Pub 41009
PHASE JITTER, DEGREES, PEAK TO PEAK
PHASE JITTER, DEGREES, PEAK TO PEAK

Figure 1. STD + LF measurement mode responds to low-frequency perturbations, as well as standard phase jitter. A higher STD + LF reading verifies the presence of low-frequency phase jitter. (The plots have been expanded on each side of the reference tone to show more clearly the low-frequency filter characteristics.)

c. WIDEBAND. This mode accepts any test tone frequency from 500 Hz to 3 kHz. It measures all components throughout this bandwidth except for those within ±14 Hz of test tone frequency or its harmonics (3 dB points). Figure 2 compares the response of the STD and the WIDEBAND operating modes.

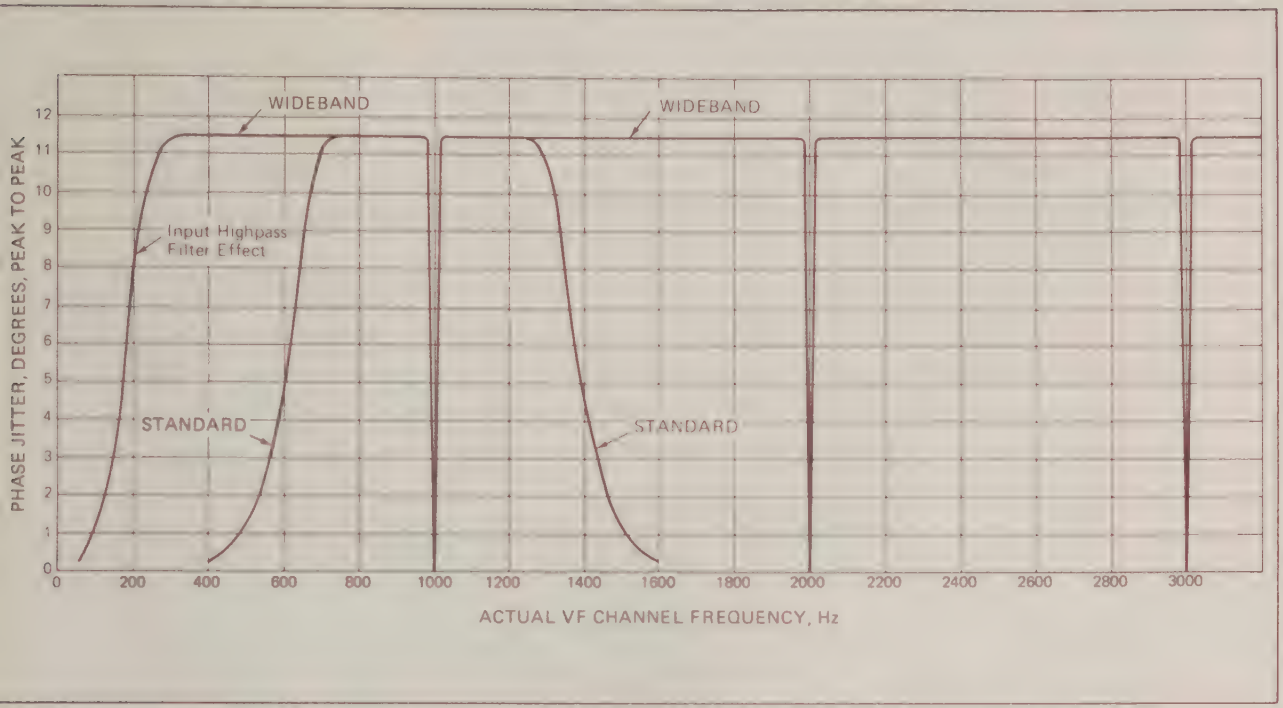


Figure 2. STANDARD measurement mode responds to approximately 700 Hz bandwidth centered about test tone, while WIDEBAND mode provides virtually flat response above 300 Hz with notches at harmonic frequencies. Comparison of readings in the two modes provides the basis for isolating true phase jitter from the effects of noise.

CXR Phase Jitter Tests

3.04 The 1202B Test Set has the capability for the direct measurement of phase jitter at carrier frequencies. When the proper CXR push-button is selected, the carrier frequency under test is internally heterodyned down to 1 kHz for the actual jitter measurement. Phase jitter measurements are made in the same manner as for VF tests. The only exception is the input signal level limits, which extend from -30 dBm to +10 dBm. If the input level drops below -30 dBm, the MON indicator will illuminate. This compares to -40 dBm for VF measurements.

Dialing Up a VF Test Circuit

3.05 To dial up a test circuit, proceed as follows:

a. Set the DIAL/MEASURE switch to DIAL.

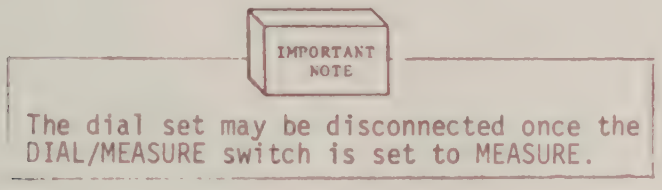
b. Select the proper VF termination: 600 ohms or 900 ohms.

c. Connect a dial set to the dial jack.

d. Dial up the circuit.

e. Place the DIAL/MEASURE switch to MEASURE before unplugging the dial set.

f. Read the measurement on digital display



4. SPECIFICATIONS

Measurement Modes

Standard.	Responsive to components within ±(14 Hz to 350 Hz) of test tone frequency (3 dB points).
STD + LF.	Responsive to components within ±(5 Hz to 350 Hz) of test tone frequency (3 dB points).
Wideband.	Responsive to all components throughout full bandwidth of applied signal, except for those components below 210 Hz and those within ±14 Hz of test tone frequency (3 dB points). Not responsive to test tone harmonics.

Display

Type.	Digital, 3 Nixie tubes, with over-range indicator. Direct readout of peak-to-peak phase jitter.
Range	00.0 to 99.9 degrees (single range)
Resolution.	0.1 degree (throughout full range)

Measurement Accuracy (for jitter frequency of 100 Hz)

0° to 30°	±1.0% of reading ±0.2 degree
30° to 60°.	±2% of reading ±0.2 degree

Measurement Variation vs. Jitter Frequency

(STANDARD and (STD + LF)

20 Hz to 300 Hz.	±3% of reading referenced to 100 Hz jitter frequency.

VF Test Requirements & Input Characteristics

Test Tone Frequency	
STANDARD and STD + LF Modes . .	1020 Hz ±40 Hz
WIDEBAND Mode	500 Hz to 3 kHz
Input Level.	-40 dBm to +10 dBm
Impedance	
Terminating	600 or 900 ohms, balanced
Bridging.	20 K ohms at 1 kHz, balanced
Longitudinal Balance, Input. . . .	50 dB @ ≤6 kHz
Input Protection	
Metallic: Bridging	300 Vdc
Terminating.	50 Vdc, 600 V for 10 µsec
Dial	90 V rms + 48 Vdc
Longitudinal.	300 V rms @ 60 Hz 600 V for 10 µsec to ground
Return Loss.	30 dB, or greater than 100 Hz to 3500 Hz
Terminal	Jack for 310 plug on front panel. Terminal strip on rear panel.

Carrier Frequency Test Requirements and Input Characteristics (1202B only)

Test Frequency	Group A (60 kHz to 320 kHz): 108 kHz standard other frequencies on special order Group B (1 MHz to 5.5 MHz): 3.100 MHz standard 3.396 MHz standard other frequencies on special order
Input Level.	-30 dBm to +10 dBm
Impedance.	75 ohms, unbalanced

Residual Phase Jitter	Less than 0.2° p-p
Terminal	Coaxial jack for 358 plug on front panel. No rear terminals.

Oscillator Output

Frequency	1010 Hz ±2.0 Hz
Level	0 dBm or -29 dBm Selectable by front panel switch.
Impedance	600 ohms, balanced
Residual Phase Jitter	Less than 0.1° p-p
Harmonic Distortion	All harmonics -60 dB or more relative to fundamental.
Terminal	Jack for 310 plug on front panel.

Analog Output

Level	Phase jitter, output, prior to peak-to-peak detector. Output level proportional to phase jitter reading. 10° = 1 volt ±10%.
Source Impedance	10,000 ohms, unbalanced
Terminal	Terminal strip on rear panel.

Power Requirement

Voltage	115/230 volts ac ±10%
Frequency	45 Hz to 400 Hz
Current	200 mA

Size

Height	5-1/4 inches
Width	7-3/4 inches (8-7/8 inches with handle)
Depth	11-1/4 inches
Weight	9-1/2 pounds
Operating Temperature Range	0° to 50°C

WARRANTY

TTI warrants instruments manufactured by it to be free from defects in material and workmanship under normal use and service within specified ratings and operating conditions. Our obligation under this Warranty is limited to the repair or replacement, at TTI's sole discretion, of any instrument or part thereof which, when returned to TTI within one year of original shipment and upon our examination proves to be thus defective. This warranty includes the cost of return surface transportation from the factory. It does not include the cost of transportation to the factory and/or the cost of packaging the instrument for return to the factory, unless such instrument is returned within 30 days from the date of original shipment and prior written authorization for the reimbursement of such cost is obtained from the factory.

This Warranty shall not apply to any instrument which has been (1) repaired, worked on, or altered by persons not authorized by TTI so as, in TTI's sole judgement, to injure the stability, reliability, or proper operation of such instrument; (2) subjected to mususe, negligence, or accident, and (3) connected, installed, used or adjusted otherwise than in accordance with the instructions furnished by TTI. Accessories, including, but not limited to, fuses and batteries, not of TTI's manufacture, used or installed with this instrument are not covered by this Warranty.

TTI reserves the right to make changes in the design or construction of its instruments at any time without incurring any obligation to make these changes in instruments previously sold and delivered.

The repair or replacement of any part or parts of an instrument under this agreement does not void or extend the original Warranty period for the whole instrument. Repaired or replaced parts are warranted for the remainder of the instrument warranty period or for 90 days from the date of repair, whichever shall be longer.

We are not liable for consequential or incidental damages. This Warranty is in lieu of all others expressed or implied and no representative or person is authorized to assume for us any other obligations or liabilities in connection with the sale of TTI instruments and products.

In the event of malfunction, please complete this report and return it in the shipping container with the instrument. A shipping label is attached for your convenience.

Company_____
Dept_____
Address_____
_____
Instrument Model # _____
Serial # _____
TTI Shipping Date_____

From_____
_____
_____

To: Telecommunications Technology, Inc.
555 Del Rey
Sunnyvale, California 94086

(Shipping date appears on last page of instruction manual. Warranty expires one year from this date.)

☐ Please furnish estimate before proceeding with repair.

DETAILED DESCRIPTION OF MALFUNCTION

Signature_____
Title_____

FACTORY REPAIR SERVICE

TTI maintains a complete facility to repair any TTI instrument, whether or not the necessary repair is covered by the warranty.

Malfunction Report

Any instrument returned to the factory for repair, whether covered by warranty or not, should be accompanied by the malfunction report (the following page of this manual). This report should be completed in as much detail as possible to assure quick and complete correction at the factory.

Shipping Instructions

Make sure the instrument is adequately packed to prevent damage in transit. TTI will not be responsible for such damage. If possible, the instrument should be returned in its original shipping container. If this is not possible, use a shipping container that allows for at least four inches of high-quality packing material on every side of the instrument.

Ship the instrument prepaid to

Telecommunications Technology, Inc.
555 Del Rey
Sunnyvale, California 94086

The tear-out shipping label on the malfunction report may be used.

Charges

The warranty does not cover shipping charges to the TTI factory. However, if the instrument is in warranty, TTI will pay the cost of surface shipment from the factory.

If the instrument is not in warranty, TTI will bill for the repair at normal rates. Shipping costs will be billed at TTI's cost.

Instrument serial number_____

TTI Shipping date_____

DUO-TANG
3530
MADE IN U.S.A.